Comparison of Maternal Nutritional status in Premature and Intra Uterine Growth Restricted Neonates in Hayatabad Medical Complex, Peshawar

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ABSTRACT

Background: Low Birth weight (LBW) is a major determinant of infant mortality and adverse health outcomes. LBW mainly results from prematurity or Intrauterine Growth Restriction (IUGR). Pakistan has low birth weight rate of 32% and fourth highest number of preterm births in the world. LBW in developing countries mainly results from poor maternal health and nutritional status.

Objectives: To compare the maternal nutritional status in premature and IUGR neonates

Material and Methods: A cross sectional comparative study was conducted in neonatal care unit of Hayatabad Medical Complex, of Peshawar, over a period of six months. 250 LBW newborns and their mothers were included in the study, using consecutive sampling technique. Newborns with birth weight < 2.5 kg were defined as LBW. LBW newborns were divided in Premature (Between 28 & 37completed weeks of gestation)and IUGR (birth weight < 2.5 kg & gestational age ≥ 37 weeks). Maternal nutrition status was assessed by measuring dietary intake, hemoglobin level estimation and Body Mass Index (BMI) calculation. Chi-square test was applied to determine the association of maternal nutritional status with prematurity and IUGR in newborns. At 95% Confidence level, p value <0.05 was taken significant.

Results: Analysis showed that among 250 newborns, 150 (60%)were males. Low birth weight of newborns was mainly due to IUGR147 (58.8%).Socio-demographic characteristics showed that 193 (77.2%) mothers were uneducated and 174 (69.6%) mothers were below 20 yrs of age. Maternal nutritional assessment indicated, low caloric dietary intake in 139 (55.6%) mothers and hemoglobin level of less than 11gm/dl in152 (60.8%) mothers, while BMI data analysis showed that 62 (24.8%) mothers were underweight and 25 (10%) were overweight. Overall, there was no significant association between maternal nutrition status and prematurity or IUGR.

Conclusion: LBW was mainly due to IUGR. However, our study could not establish association of IUGR/Prematurity with maternal nutrition status.

Key Words:*Pakistan, Low birth weight, Fetal growth retardation, Premature, Nutritional status*

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INTRODUCTION:

Low birth weight(LBW) is defined as "birth weight less than 2500 gm(5.5lbs)".[1]LBW mainly results from prematurity (Gestational age < 37completed weeks), or Intrauterine Growth Restriction (IUGR) (birth weight < 2.5 kg & gestational age ≥ 37 weeks) or both[2]. Low birth weight is not only a key predictor of neonatal & infant mortality and morbidity, but also of the health outcome in adult life.[1]LBW contributes to 60% to 80% of all neonatal deaths.[3] Those who survive suffer life long disability both mental and physical. Similarly LBW infants are at higher risk of chronic diseases and premature death later in life.[2,3]

Low birth weight is one of the significant public health problems, particularly for developing countries. The global prevalence of LBW is 15.5%, translating into 20 million LBW births each year; 96.5% of them in developing countries.[3]Pakistan is one of the developing countries with LBW rate of 32%[4]as well as has fourth highest number of preterm births (748,100) in the world[5].LBW in developing countries primarily results from poor maternal health and nutrition[6]. Maternal under nutrition, resulting into anemia and low Body Mass Index (BMI)[7] is suggested to be a strong predicitor for LBW particularly IUGR[6,7,8]. However, the extent of influence on birth weight is unclear because of the effect of confounding variables such as maternal education and socioeconomic status.[9]

The high prevalence of LBW in Pakistan may be related to maternal under-nutrition as revealed by Pakistan National Nutrition Survey (NNS) 2010-11 that 50% of the women and children are malnourished at National level. A total of 18% of women of reproductive age were under weight, 51% of pregnant women have iron deficiency anemia.[10]Maternal nutrition is a modifiable risk factor of public health importance that can be integrated into efforts to prevent adverse birth outcomes, particularly among socio-economicaly deprived populations of developing countries[11]. The study will help in understanding the effect of

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maternal nutrition status on neonatal outcome in terms of birth weight and providing evidence for developing nutritional interventions targeting women in general and pregnant women in particular.

MATERIALAND METHODS

This cross-sectional study was conducted from July to December 2013 at the neonatal care unit of Hayatabad Medical Complex(HMC), Peshawar. The study included all the singleton alive newborns with birth weight< 2.5 kg admitted at the neonatal care unit of HMC and their mothers. Newborns born by multiple pregnancies, those with congenital malformation were excluded. Mothers of newborns with history of gestational diabetes mellitus, pregnancy induced hypertension, antepartum hemorrhage, chronic infections or other co-morbidities during present pregnancy, were also not included in the study. Sample size was calculated by using WHO sample size calculator for cross-sectional study with anticipated proportion of LBW of 0.32[4], relative precision of 0.05 and 95% of Confidence Level generated a sample size of 250.

Ethical approval was obtained from the Ethical Board of Gandahara Medical University, Peshawar and permission was seeked from administration and head of paediatric department, HMC, Peshawar. Before enrollment in study, the purpose of the study was explained to participants and Informed consent (verbal/written) was obtained. Data was collected by the principal investigator, through interview technique using pretested structured questionnaire, anthropometry of newborn& mothers and abstraction of medical records, where required. Questionnaire was pretested and necessary changes were made as required.

Information was obtained from mothers of the newborn. Data was collected for maternal age, parity, socioeconomic status, educational status, antenatal care received, total number of children. Maternal nutrition status was assessed using the maternal Body Mass Index, maternal anemia levels and dietary assessment. Maternal anemia was defined as hemoglobin level of less than 11 gm /dl of pregnant women at the time of admission for delivery[12]and was determined from hospital record. For the purpose of study the pre-pregnancy weight and weight gain during pregnancy were not available, the post-partum weights were taken. Maternal weight was measured in Kilogram using adult weighing scale. Maternal height was measured against a standard wall height scale in meters. Body Mass Index (BMI) defined as weight in kilogram divided by height in meters squared weight (kg) ÷ [height (m2) was calculated and classified according to WHO criteria as underweight (<18.5), normal (18.5-24.9), overweight (25-29.9) and obese (>30).[13]

Dietary assessment of pregnant women was done by the trained nutritionist using dietary recall method. The information was about about daily intake of food items from different food groups (Cereals, fruits, vegetables, dairy products, meat & poultry & Eggs and legumes) and their quantities considering standard cup sizes. Probing questions were used to help the subjects to remember all foods and drinks consumed during pregnancy. Average daily intake of food items from different food groups and caloric intake were measured and compared with Daily Food Guide for Pakistani population (pregnant women) and food composition tables for Pakistan standards.[14,15]

Weight of all newborns were measured using lightweight,fibreglassinfantometer, by trained staff. Newborns were weighed with minimum clothing. Scale was standaridized and caliberatedbefore weighing. Weight was recorded in kilograms. Newborn withbirth weight < 2.5 kg were defined as Low birth weight.[1]Gestational age was estimated on the basis of the last menstrual period and/or a first-trimester ultrasound.[16]Newborns were categorized into full term ($\geq$ 37 wks of gestation), premature (Between 28 wks &37 wks of gestation) and IUGR (Birth weight < 2.5 kg and gestational age $\geq$ 37 Weeks).[2] Sex of newborn was also recorded.

Statistics

Data was analyzed using statistical package (SPSS 16.0 version). Descriptive analysis frequencies, proportions & percentages for categorical variables (gender, maternal anemia, BMI categories, education level, socio-economic status, antenatal care obtained) was done. For analytical inferences, Chi-square test was used; cross tabulating the independent variables across the categories of outcome (premature and IUGR). A cut off of $p < 0.05$ at 95% confidence level was taken as significant in this study.

RESULTS

There were 250 low birth weight newborns in the study; 150 (60%) male newborns had LBW. LBW was mainly due to IUGR 147 (58.8%) (Figure 1).Analysis of socio-demographic characteristics of participants showed that 176 (70.4%) participants had urban residence. Maternal illiteracy was common finding with 193 (77.2%) mothers being uneducated. There were 174 (69.6%) mothers below 20 yrs and 50 (20%) above 35 yrs. of age. Nutritional assessment showed the poor dietary intake in 139 (55.6%) mothers and maternal anemia (hemoglobin level of less than 11gm per dl) in 152 (60.8%) mothers. Body Mass Index data analysis showed that 62 (24.8%) mothers were underweight, 25 (10%) were overweight(Figure 2).

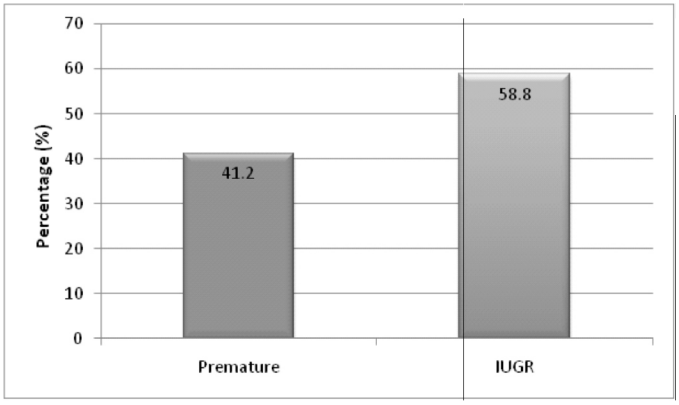


Figure 1: Distribution of premature and IUGR in study group

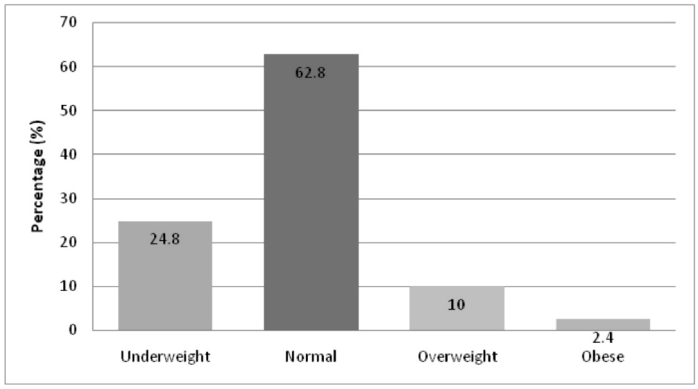


Figure 2: Distribution of maternal Body Mass Index in study group

Results related to maternal obstetric characteristics showed that 78 (31.2%) were primigravida and 126 (50.4%) were multigravida. Age at marriage was below 20 years in 150 (60%) mothers. Antenatal care was received by 221 (88.4%) mothers during present pregnancy; 113 (45.2%) ofthesemothers made four or more visits to a health facility for ante-natal care. 79 (31.6%) women had their first pregnancy and 128 (51.2%) women had inter pregnancy interval of less than two years.

Gender distribution among LBW newborn showed prematurity being more common in male newborns, however the association was not significant (p = 0.173) **(Table 1)**.Maternal socio-demographic characteristics were analyzed against the categories of low birth weight and no significant association was found (Table 1). There were more LBW births to teenage mothers however, no significant difference was observed in distribution of prematurity and IUGR in relation to young maternal age (p = 0.365). Maternal illiteracy was commonly observed in mothers of both premature and IUGR, however, the association was insignificant (p = 0.649). Similarly monthly income and area of residence has no significant effect on birth outcome. Similarly area of residence could not be associated with prematurity or IUGR (p = 0.889).

Maternal nutrition status was assessed using maternal dietary intake during pregnancy, hemoglobin level and Body Mass Index as indicators. The underweight mothers were found to have more IUGR births, however the association was insignificant (p = 0.094). Dietary caloric intakes of mothers was found to have no significant effect on birth weight and gestational age of newborn (p = 0.699). Maternal anemia was common in mothers of LBW newborns (62%), however, no difference was observed in distribution of maternal anemia between premature and IUGR neonates (p=0.869)(Table 2)

Analysis of maternal obstetric characteristics against LBW categories showed that young age at marriage had significant association with prematurity (p = 0.005).There were more premature(49.5%) and IUGR births (51%) to multigravida, but association was insignificant (p = 0.939). Less than two years interval between indexed and previous pregnancy was seen in 55% mothers of premature newborns as compare to 48% in IUGR neonates, however the association was statistically insignificant (p = 0.493).Antenatal care received by mothers of premature newborns could not improve birth outcome in term of birth weight and gestational age. IUGR was found to be associated with less than four antenatal visits made by their mothers, however, the association was insignificant (p = 0.201)(Table 3).

Table 1: Descriptive Analysis of Socio-demographic characteristics of study participants

Variables/Factors	Premature N = 103 n %	IUGR N = 147 n %	P - value
Neonate Gender:			
Male	67 (65)	83 (56.5)	0.173
Female	36 (35)	64 (43.5)	
Maternal Age			
< 20 yrs.	73 (70.9)	101 (68.7)	
20 - 35 yrs.	7 (6.8)	19 (12.9)	0.365
> 35 yrs.	23 (22.3)	27 (18.4)	
Maternal Education			
Uneducated	78 (75.7)	115(78.2)	0.649
Educated	25 (24.3)	32 (21.8)	
Residence			
Urban	72 (69.9)	104 (70.7)	0.889
Rural	31 (30.1)	43 (29.3)	

Table 2: Comparison of maternal nutritional status in Premature and IUGR Neonates

Variables/Factors	Premature N = 103 n %	IUGR N = 147 n %	P value
Dietary Caloric Intake:			
Adequate	59 (57.3)	80 (54.4)	0.699
Inadequate	44 (42.7)	67 (45.6)	
Maternal Anemia			
Present	62 (60.2)	90 (61.2)	0.896
Absent	41 (39.8)	57 (38.8)	
Maternal Body Mass Index			
< 18.5	31 (30.1)	31 (21.1)	
18.5 - 24.9	62 (60.2)	95 (64.6)	0.094*
> 25 - 29.9	10 (9.7)	15 (10.2)	
≥30	0	6 (4.1)	

Fisher Exact test used for statistical analysis*

Table 3: Descriptive Analysis of Maternal obstetric characteristics associated with Prematurity and IUGR

Variables/Factors	Premature N = 103 n %	IUGR N = 147 n %	P -value
Age at marriage			
< 20 yrs.	**74 (71.8)**	**76 (51.7)**	**0.005**
≥20 yrs.	**29 (28.2)**	**71 (48.3)**	
Gravidity:			
Primigravida	32 (31.1)	47 (32.0)	
Multigravida	51 (49.5)	75 (51.0)	0.939
Grandmultigravida	20 (19.4)	25 (17.0)	
Inter pregnancy Interval:			
First pregnancy	32 (31.0)	47 (32.0)	
<2yrs	57 (55.4)	71 (48.3)	0.493
≥ 2 yrs	14 (13.6)	29 (19.7)	
Antenatal care received:			
Yes	91 (88.3)	32(21.8)	0.692
No	13 (12.6)	15 (10.2)	
No. of antenatal visits:			
No visits	13 (12.6)	15 (10.2)	
< 4	38 (36.9)	71(48.3)	0.201
≥ 4	52 (50.5)	61 (41.5)	

DISCUSSION:

Hospital based cross section study was conducted to determine association of maternal nutritional status with low birth weight groups (premature and IUGR). Low birth weight was more common in male neonates and was mainly due to IUGR. Maternal BMI, hemoglobin level were low and their dietary intake was inadequate. Teenage marriages, early and child bearing and short interval between pregnancy were commonly found in the study. Antenatal care received by mothers could not improve birth outcome. Socio-demographic data showed that two third participants belonged to urban areas and majority were uneducated.

Gender analysis in our study revealed more male neonates with LBW. Similar findings were given by Ayesha et al.[16]showing more male neonates with LBW (52%) in her study. Conversely, a study by Baghianimoghadamand colleagues found female predominance in LBW group (62%).[17]Mendes et al in Brazil also found the association of LBW with female gender (OR = 1.472), in their study.[18]According to the UNICEF report, for the same gestational age, girls weigh less than boys. firstborn infants are lighter than subsequent infants, and twins weigh less thansingletons[2].

In our study, most of LBW neonates were IUGR. As the literature suggests that LBW in developing countries is mainly due to IUGR. Public health significance of IUGR is associated with poor growth in childhood and higher incidence of chronic diseases in adult life[2].These infants are also at risk of mental retardation, low I.Q, learning disabilities, poor school performance, childhood psychiatric disorders as well as visual & hearing impairments.[19,20] The association between low birth weight and prematurity is described in several studies;[18,21]however a systematic review with meta-analysis found this association to be inadequate. The authors are of the view that prematurity may be linked to erroneous calculation of the expected date of delivery and to the increased rate of cesarean sections.[22]

Our study could not established association of either prematurity or IUGR with maternal nutritional status, and other maternal socio-demographic and obstetric risk factors as suggested by literature.

LBW in developing countries primarily results from poor maternal nutrition and health.[6]Evidence suggested that nutritional factors may account for 60% of the observed variations in birth weight.[23]Maternal under-nutrition, caused by chronic energy, protein and micronutrient deficiencies, can predict adverse birth outcomes,

in term of preterm birth and fetal growth retardation.[8,23,24]Although, most of the fetal weight gain occurs during the last trimester. However, the influences of nutrients are not limited to the second or third trimester. Animal studies indiated that inadequate diet around peri-implantation stage affect fetal growth to a critical extent.[8]

Maternal under-nutrition is determined by short stature, a low pre-pregnancy BMI and poor weight gain during pregnancy.[24]Theseanthropometric measures have been significantly associated with intrauterine growth & prematurity and can be viewed as "predictors" ofLBW[23].Low pre-pregnancy body mass index (BMI) is suggested to be one of strongest predictors of adverse pregnancy outcomes such as preterm birth and fetal growth retardation. An underweight mother has 30% higher risk of delivering a LBW baby than her well-nourished counterpart.[8] In a s study by Dahlui and colleagues[20], multiple logistic regression analysis showed an adjusted significant odds ratio for maternal weight of less than 70 kg (a OR 1.92; 95% CI [1.32 -2.78]) in association with LBW. A national study conducted in northeastern Brazil found the association of pre-term birth with inadequate maternal weight gain (OR = 2.33).[18] A study in Thailand found the incidence of LBW strongly related to a maternal BMI lower than 18.5 kg/m^2 and weight gain in the second trimester of less than 300 grams per week.[25]

Maternal anemia is another well known factors affecting birth weight[10]. Evidence of a linear doseresponse relationship between LBW risk and dietary iron with risk decreasing 3% for every 10 mg additional iron intake, was observed in a systematic review by Haider et al.[26]Similarly low hemoglobin level was found to have a significant association with LBW (P<0.026) in a study by Iltaf G and colleagues.[27]

In our study, maternal nutrition status was determined using maternal dietary intake, anemia, and BMI. Maternal weight measured at time of admission for delivery was used for calculating BMI. Pre-pregnancy BMI and weight gain during current pregnancy could not be calculated as majority of mothers did not know their pre-pregnancy weight and had poor antenatal record keeping. Similarly hemoglobin levels of pregnant women, measured at the time of admission, were used to determine maternal anemia. It was, therefore, not possible to conclude whether the mothers were already anemic before conception or they became anemic at some stage in pregnancy. Almost half of the mothers were found to be hemoglobin deficient, but maternal anemia could not be associated with LBW. Almost no difference was observed in distribution of maternal dietary intake, maternal anemia among premature and IUGR newborns. However, low maternal BMI was more frequent in IUGR neonates than premature, but association was insignificant.

Maternal under-nurition is quite prevalent in Pakistan. According to Pakistan NNS 2010-11, half of the women were undernourished at National level. The prevalence of under nutrition, anemia and iron deficiency along with some other micronutrient deficiencies was found to be higher among the pregnant women. The pregnant women are considered to be a nutritionally vulnerable segment of the population due to increase nutrition demand during pregnancy for fetal growth.[10]

In our study significant association was found between early marriages and prematurity. Similarly, young maternal age, high parity, repeated pregnancies with short inter pregnancy interval were found to be associated with prematurity and IUGR, however, association was insignificant. Smilarly in a study by Mendes[18] the risk of LBW was found to be associated with maternal age below 20 years old (OR = 1.323). Birth interval of less than three years was found to have a significant association with LBW in a study by Iltaf G.[27]

Early marriage are common traditional practices in Pakistan and child bearing begin soon after marriage[28].Pakistan is among the top ten countries in the world with largest number of adolescent child bearing[29]with Khyber Pakhtunkhwa (KP) having the highest percentage (10%) of teenage child bearing. 37% of births occur within two years of a previous birth.[30]Social norms, poverty, illiteracy, lack of awareness about reproductive sexual health, lack of access to family planning services, incorrect use of contraception can explain these practices.[31]

No association was found between maternal education level and LBW in our study. However in other studies the mothers' education and occupation were found to have significant correlation with LBW[18,27,32]. In our study two third of the mothers were uneducated. Similar findings were given by PDHS 2012-13, showing that 57% of women at national level and 72% in Khyber Pakhtunkhwa, have never attended the school.[30] Education level is closely related to socio-economic status[30] and lower education level of our study participants can be explained by their low socio-economic status.

Conclusion:

LBWof the newborns was mainly due to IUGR. High rate of IUGR in our study may indicate poor maternal nutritional status, as shown by the poor dietary intake, maternal anemia and low BMI in our study. However, our study could not establishassociation of IUGR/Prematurity with maternal nutrition status. Low parental education, early marriages and child bearing were significant findings in our study, which are areas of concern and need attention to immporove maternal and child health.

Strength and Limitations

Multiple indicators were used in our study to assess the maternal nutrition status i.e dietary caloric intake, hemoglobin level estimation and Body Mass Index calculation. Probing questions were used to help the subjects to remember all foods and drinks consumed during pregnancy. Average daily intake of food items from different food groups and caloric intake were measured and compared with Daily Food Guide for Pakistani population (pregnant women) and food composition tables for Pakistan standards. The weighing scales used in our study were standardized and calliberated to remove systematic error in data collection.

Limitations of study include; Firstly, it was an observational study design (cross sectional) and evidence generated to measure association between maternal nutrition status and LBW may not be strong. Secondly, the data collected was based on information provided by the study participants and examination of medical records, which are subject to recall and reporting biases. Finally, it was a hospital based study, care should be observed while generalizing study results to general population.

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